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Slow and fast light propagation of quantum optical fields under the conditions of multi-photon resonances in a coherent atomic vapor GLEB ROMANOV, NATHANIEL PHILLIPS, EUGENIY MIKHAILOV, IRINA NOVIKOVA, The College of William & Mary — We investigate a weak signal pulse propagation in a N interaction scheme, in which a resonant Λ link formed by single weak signal and strong control field, traditionally associated with electromagnetically induced transparency, is perturbed by an additional optical transition. We focus on two configurations. In the first case, relevant for EIT-based slow light and quantum memory, we take into account the off-resonant coupling of the strong field to the signal field ground state. In the second configuration the additional control field is derived from an independent laser, and it is tuned to a different optical resonance from the ones forming an original Λ system. Such interaction scheme allows was considered with regards to enhancement of optical gyroscopes performance. We demonstrate that in both cases the four-wave mixing (FWM) has a profound effect on signal field group velocity and absorption profile, and may even lead to gain. We demonstrate that in such perturbed EIT systems with FWM it may be possible to tune a signal field propagation from superluminal to slow light regimes. We present both semi-classical and fully quantum treatment for propagation of both signal and newly generated Stokes fields that include accurate description of their quantum noise.

Gleb Romanov
The College of William & Mary

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